A NEW SPECIES OF *PARUROCTONUS* (SCORPIONES: VAEJOVIDAE) FROM BIG BEND NATIONAL PARK, TEXAS[1]

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ABSTRACT. — A new species of the *baergi* microgroup of the genus *Paruroctonus* is described from sand dunes along the Rio Grande River in Boquillas Canyon, Big Bend National Park, Texas. Variation in setal characteristics is summarized.

As a result of taxonomic surveys of scorpions in Big Bend National Park, one of us (RNH) collected specimens of a *Paruroctonus* Werner species in the short stretch of sand dune habitat at the end of the Boquillas Canyon Trail. The specimens were very similar to *P. utahensis* (Williams), which has a wide distribution from southern Utah and northwestern Arizona, through much of New Mexico to the northern portions of the Trans-Pecos in Texas and the Samalayuca Dunes in extreme northern Chihuahua. The site in Big Bend represents a considerable disjunction and, after study, it was ascertained that the specimens represented a new species in the *baergi* microgroup that differs dramatically from *P. utahensis* in several important characters. It is the purpose here to describe this new species.

Accessible sand dune communities are found in only a few locations in the Big Bend region and, thus far, we have found this species only in Boquillas Canyon. Sandy habitats along the Rio Grande in the Big Bend Ranch State Park (e.g., Arenosa, Grassy Banks, Madera Canyon) have been sampled, but this species was not encountered. Dune systems are much more extensive on the Mexican side of the Rio Grande, however, and the new species would be expected to occur there.

Paruroctonus boquillas, NEW SPECIES

(Figs. 1-8)

Type Data. — Adult male holotype from sand dunes in Boquillas Canyon (N29.12.02: W102.55.11), Big Bend National Park, Brewster Co., Texas, USA on 20 May 1996 (R. N. Henson, et al.); deposited in the United States National Museum (Smithsonian Institution), Washington, D. C.

Distribution. — Known only from the type locality.

Etymology. — The specific epithet is derived from the type locality, Boquillas Canyon, and is used as a noun in apposition.

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Diagnosis. — Haradon (1983, 1984a, 1984b, 1985) established a number of setal characters that he determined to be of great significance in species recognition in the genus *Paruroctonus*. Utilizing these and other characters listed below, *P. boquillas* clearly belongs in the *baergi* microgroup, a subgroup of the *boreus* infragroup. The *baergi* microgroup was defined (Haradon 1984a) as lacking the mid-retrosuperior seta (*mrs*) on the basitarsus (tarsomere I) of leg II; having pectinal tooth counts usually in excess of 22 in males and 18 in females; having the pedipalp chela with well developed, granulose carinae in adults of both sexes; and having 25-44 primary row denticles on the cutting margin of the pedipalp chela fixed finger and 35-57 such denticles on the movable finger (excluding the basal row in both cases).

In bearing four long retrosuperior setae of equal length on the telotarsus (= tarsomere II) of leg III and an *mrs* seta on the basitarsus of the same leg, *P. boquillas* is most similar to *P. utahensis* and *P. baergi* (Williams & Hadley). It differs from both *P. baergi* and *P. utahensis* in having higher setal counts on most metasomal carinae of segments I-IV (Table 1 summarizes counts for *P. boquillas*) and four external medial setae on the pedipalp femur. Because it has only one retromedial seta on telotarsus III, typically 2 inframedial setae on the pedipalp femur, lower pectinal tooth counts in males (23-28 vs. 29-37) and exhibits slightly more distinct scalloping in the chela fingers (in both sexes), it is readily distinguished from *P. utahensis*. From *P. baergi* it can be further distinguished by having four internal chelal macrosetae (not two) and more subtle scalloping in the chela fingers of the male.

Paruroctonus boquillas is very similar to *P. arenicola* Haradon in terms of its setation patterns. It may be distinguished from that species by having four long retrosuperior setae on telotarsus III (rather than three, or three long and one short setae) and by having fewer setae on the inner aspect of the pedipalp chela fingers. From *P. arenicola arenicola* Haradon of the Amargosa Desert in Nevada, it further differs by having 1, 1, 1-2, 2 setae on the dorsolateral metasomal carinae of I-IV (rather than 1, 3, 3, 3-4) and by having the chela fingers yellowish (rather than orange, contrasting to color of palm). From *P. arenicola nudipes* Haradon of the eastern Mojave Desert in California, it differs by having the *mrs* seta present on telotarsus III and by the setal pattern of the dorsolateral carinae of I-IV (in *P. a. nudipes* there are 0, 1, 1, 2 pairs of setae).

Description: Based on the male holotype. Coloration: Dorsum, metasoma, pedipalps, and legs light yellow; venter slightly paler; pectines whitish; dentition of pedipalp chela fingers, cheliceral fingers, and tip of telson dark reddish brown to reddish black.

Prosoma. Anterior margin of carapace straight, set with four pairs of reddish setae. Entire carapacial surface densely coarsely granular.

Mesosoma. Tergites I-VI: median carina on II-VI present on post-tergite, granular. Tergite VII: median carina vestigial, granular; submedian and lateral carinae strong, irregularly serrated. Pectinal teeth numbering 24-24. Sternites III-VI densely minutely granular laterally; smooth, lustrous, and punctate medially. Sternite VII with pair of moderate crenulate lateral carinae.

Metasoma (Fig. 1). Segment I slightly longer than wide, III 1.43 times longer than wide; segment V 3.21 times longer than wide. Segments I-IV: Dorsolateral and lateral supramedian carinae on I-IV strong, serrate. Lateral inframedian carinae on I complete, strong, irregularly serrate; on II represented by four serrated posterior granules; on III represented by three serrated posterior granules; on IV absent. Ventrolateral carinae on I-II strong, smooth; on III-IV strong, smooth with a few posterior serrations. Ventral submedian carinae on I weak, smooth; II moderate, smooth; on III strong, smooth; on IV strong, smooth with posterior serrations. Carinal setation of segments I-IV (L/R): dorsolaterals 0/1,1/1,1/1,2/2; lateral supramedians 1/0,2/2,2/3,3/3; lateral inframedians 2/2,0/0,0/0,0/0; ventrolaterals 2/2,4/3,4/4, 5/5; ventral submedians 3/3,4/4,4/ 4,4/5. Segment V: Dorsolateral carinae strong, feebly crenulate; lateromedian carinae present on anterior one-half, strong, irregularly serrate; ventrolateral and ventromedian carinae strong, serrate. Carinal setation of segment V: dorsolaterals 4/4; lateromedians 3/2; ventrolaterals 10/11.

Telson (Fig. 1). Elongate; dorsal surface flattened, smooth; ventral surface essentially smooth, with 12 pairs of larger setae; aculeus weakly curved.

Chelicera (Figs. 2-3). Ventral aspect of cheliceral fixed finger with smooth carina extending length of finger. Ventral margin of movable finger mostly smooth, with one small rounded denticle near the base.

Pedipalp. Trichobothrial pattern Type C, orthobothriotaxic (Vachon 1974). Femur: Dorsointernal, ventrointernal, and dorsoexternal carinae, strong, serrate to serratocrenulate; ventroexternal carina represented by a few spinoid denticles. Internal face with irregularly-spaced large conical granules; three inframedial setae along ventrointernal carina (Fig. 4). External face with four medial setae (Fig. 5).

Patella: All carinae strong, serratocrenulate. Internal face with strong basal tubercle and serrated oblique internal carina. Internal face with two supramedial setae along dorsointernal carina and two inframedial setae along ventrointernal carina.

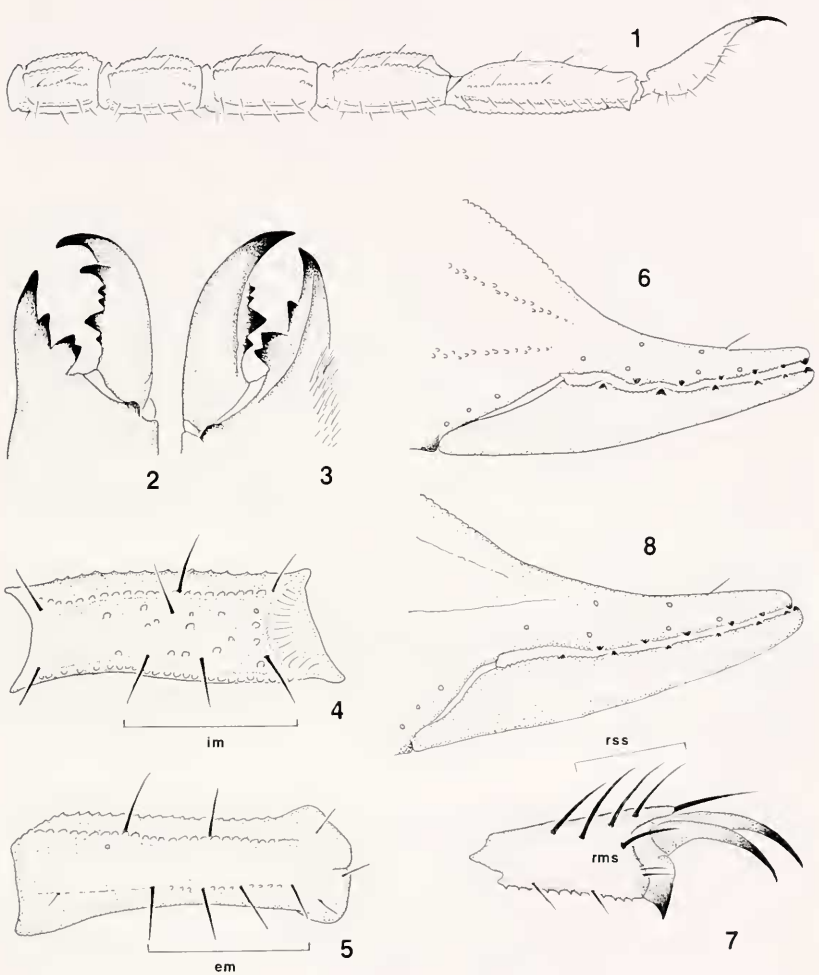
Chela. Octocarinate, with all keels strong, granulose. Dentate margin of fixed finger with primary granular row divided into six subrows by five larger granules; granules of subrows numbering 3, 6, 8, 9, 9, 22; six inner accessory granules. Dentate margin of movable finger divided into seven subrows by six larger granules; granules of subrows numbering 1, 5, 8, 10, 11, 13, 9; seven inner accessory granules. Scalloping of dentate margin of chela fingers moderate (Fig. 6). Chela length/width ratio = 3.03. Fixed finger length/carapace length ratio = 0.77; movable finger length/chela width ratio = 1.87. Internal carinae of palm with 4 macrosetae; fixed finger with 1 macroseta; movable finger with 2 macrosetae.

Legs. Basitarsus II without mid-retrosuperior (*mrs.*) seta; basitarsus III with *mrs*. Telotarsus III with four long retrosuperior setae and one long retromedial seta (Fig. 7).

Measurements of Male Holotype (in mm): total L, 49.3; carapace L, 5.6; mesosoma L (I-VII), 11.8; metasoma L (I-V), 24.8; telson L, 7.1. Metasoma: I L/W, 3.3/3.1; II L/W, 4.1/3.1; III L/W, 4.3/3.0; IV L/W, 5.4/2.7; V L/W, 7.7/2.4. Telson: vesicle L/W/D, 4.2/1.8/1.9; aculeus L, 2.9. Pedipalps: femur L/W, 4.8/1.5; patella L/W, 5.1/2.1; chela L/W/D, 9.4/ 3.1/4.1; fixed finger L, 4.3; movable finger L, 5.8.

Measurements of Female Paratype (in mm): total L, 54.2; carapace L, 6.6; mesosoma L (I-VII), 14.7; metasoma L (I-V), 25.1; telson L, 7.8. Metasoma: I L/W, 3.4/3.3; II L/W, 4.0/3.3; III L/W, 4.3/3.2; IV L/W, 5.4/2.9; V L/W, 8.0/2.6. Telson: vesicle L/W/D, 4.5/2.6/2.2; aculeus L, 3.3. Pedipalps: femur L/W, 5.3/1.8; patella L/W, 5.7/2.5; chela L/W/D, 10.4/3.1/4.0; fixed finger L, 4.8; movable finger L, 6.5.

Variation. — Females differ from males as follows: (1) the carinae of the pedipalp chelae are somewhat weaker, (2) the scalloping of the pedipalp chela fingers is weaker (Fig. 8); (3) body size is somewhat greater; (4) the metasoma is not quite as elongate; and (5) the pectinal tooth counts are lower (see below).



Figures 1-8. — Morphology of *Paruroctonus boquillas*, new species; illustrations are of the holotype male, unless otherwise stated. 1, left lateral aspect of metasoma and telson, showing carinae and setal pattern; 2, right chelicera, dorsal view; 3, right chelicera, ventral view; 4, internal aspect of right pedipalp femur, showing setal pattern (**im** = inframedial setae); 5, external aspect of right femur, showing setal pattern (**em** = external medial setae); 6, external aspect of right pedipalp chela fingers, showing degree of scalloping; 7, retrolateral aspect of right telotarsus III, showing setal pattern (**rss** = retrosuperior setae; **rms** = retromedial seta); 8, pedipalp chela fingers of female paratype

Juveniles possess fairly narrow pedipalp chelae with weakly granulose carinae and no scalloping of the chela fingers. Their setae tend to be finer than in adults, a significant factor in getting counts from the pedipalp chela fingers. The seta of the fixed finger and the distal one on the movable finger tend to be small and fine even in adults, but distinctly pigmented. In subadults and smaller juveniles, the distal diagnostic setae on the fingers tend to be microchaetes and are not included in the counts described below. Other setae in subadults were not problematic, easily determined as macrosetae.

Variation in setal counts is of critical importance to the taxonomy of *Paruroctonus*. Setal counts were taken from 25 specimens, and results are given in Tables 1 and 2. Modal counts for the various setal patterns are as follows: Metasomal setae of I-IV: dorsolaterals 1, 1, 1-2, 2; lateral supramedians 0, 2, 3, 3; lateral inframedians 2, 0, 0, 0; ventrolaterals 2, 3, 4, 5; ventral submedians 3, 4, 4, 5. Metasomal setae of V: dorsolaterals 4; lateromedians 3-4; ventrolaterals 10. Pedipalpal setae: femoral inframedians 2; femoral external medians 4; chela palm internals 4; fixed finger internals 1; movable finger internals 2. As the tables demonstrate, there was considerable variation in many of these counts. Setal counts of the retrolateral aspect of tarsi III appear to be invariable or virtually so, however, with all specimens examined having 4 retrosuperior setae and 1 retromedian seta.

In males, pectinal tooth counts ranged from 23 to 28, with the following distribution: there were 3 combs with 23 teeth, 7 combs with 24 teeth, 17 combs with 25 teeth, 19 combs with 26 teeth, 4 combs with 27 teeth, and 1 comb with 28 teeth. In females, counts ranged from 17 to 23 teeth, distributed as follows: there were 3 combs with 17 teeth, 20 combs with 18 teeth, 24 combs with 19 teeth, 15 combs with 20 teeth, 1 comb with 21 teeth, 1 comb with 22 teeth, and 1 comb with 23 teeth.

Specimens Examined (Holotype and Paratypes). - **USA:** TEXAS: BREWSTER CO.: Big Bend National Park, sand dunes in Boquillas Canyon (N29.12.02: W102.55.11), 23 May 1992 (R. Henson, T. & J. Weseman, R. Soeder), 1 subadult male, 6 subadult females (USNM); 7 June 1992, 6 subadult males, 1 juv male, 2 subadult females, 1 juv female (USNM); 25 May 1994 (R. N. Henson, J. Hosier, H. Husted, E. Kaiser), 6 subadult males, 1 female, 3 subadult females (USNM), 6 subadult males, 1 female, 3 subadult females (CAS); 20 May 1996 (R. N. Henson, et al.), 1 holotype male, 3 females (USNM), 1 male, 2 females, 2 subadult females (RNH), 2 subadult males, 2 females (AMNH), 1 male, 1 subadult male, 2 females, 2 subadult females (WDS). Depositories for materials are as follows: AMNH, American Museum of Natural History, New York; CAS, California Academy of Sciences, San Francisco; RNH, collection of R. N. Henson; USNM, United States National Museum, Washington, D.C.; WDS, collection of W. D. Sissom.

Comments. The junior author was stung on the tip of the middle finger while making one of the collections. The pain was very intense and "hot" for a period of about 10 minutes, which is not unlike many scorpion stings. However, the effects of this sting were somewhat prolonged, with edema developing in the finger that lasted for 3 days. Accompanying this was some stiffness and a throbbing ache. All symptoms disappeared by the fourth day.

Table 1. Variation in setation of the metasomal carinae of segments I-IV in 25 specimens of *P. boquillas*. DL = dorsolateral carinae; LSM = lateral supramedian carinae; LIM = lateral inframedian carinae; VL = ventrolateral carinae; VSM = ventral submedian carinae.

No.	DL				LSM				LIM				VL				VSM			
Setae	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
0	2	1			15					23	24	25								
1	21	19	13		10					2	1									
2	2	4	12	25		22	7		24				23							
3		1				3	18	23	1				2	15	8		20			
4								2						10	17	6	5	21	19	5
5																19		4	6	16
6																				4

Table 2. Variation in setal counts for metasomal segment V and the pedipalps (Ped.) in 25 specimens of *P. boquillas*. DL = dorsolaterals; LM = lateromedians; VL = ventrolaterals; Int. IM = internal inframedians; Ext. Med. = external medials; Int. Palm = internals of chela palm; Fix. Fing. = internals of fixed finger; Mov. Fing. = internals of movable finger.

No.	Metasomal V			Ped. Femur		Ped. Chela	Ped. Chela	Ped. Chela
Setae	DL	LM	VL	Int. IM	Ext. Med.	Int. Palm	Fix. Fing.	Mov. Fing.
0							8	
1							16	9
2		6		16			1	15
3		9		9	1	3		1
4	20	9			24	20		
5	5	1				2		
8			1					
9			1					
10			14					
11			9					

REVISED KEY TO THE *PARUROCTONUS BAERGI* MICROGROUP

Modified from Haradon (1984a)

1. Telotarsus III with two retrosuperior setae ..... *P. marksi*
   Telotarsus III with three or four retrosuperior setae 2
2. Telotarsus III with three long, and possibly one shorter subdistal, retrosuperior setae ..... *P. arenicola* ... 3
   Telotarsus III with four long retrosuperior setae 4
3. Basitarsus III with *mrs* seta present; paired dorsolateral metasomal setae 1, 2, 2-3, 3-4 ..... *P. arenicola arenicola*
   Basitarsus III without *mrs* seta; paired dorsolateral metasomal setae 0, 1, 1, 2 ..... *P. arenicola nudipes*
4. Pedipalp femur with four external medial setae; with 1, 1, 1-2, 2 pairs of setae on dorsolateral carinae of metasoma I-IV; with 0, 2, 2, 3 pairs of setae on the lateral supramedians; with 2 pairs of setae on lateral inframedians of metasomal segment I; with 2, 3, 4, 5 pairs of setae on the ventrolaterals of metasoma I-IV ..... *P. boquillas*
   Pedipalp femur with two or three external medial setae; with 0, 1, 1, 2 pairs of setae on dorsolateral carinae of metasoma I-IV; with 0, 1, 1, 2 pairs of setae on the lateral supramedians; with 1 pair of setae on lateral inframedians of metasomal segment I; with 2, 3, 3, 4 pairs of setae on the ventrolateral carinae of I-IV. 5
5. Telotarsus III with one retromedial seta; closed pedipalp fingers in adult male form wide proximal gap ..... *P. baergi*
   Telotarsus III with two retromedial setae; closed pedipalp fingers in adult male form narrow proximal gap ..... *P. utahensis*

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